

August 11, 2003

MEMORANDUM TO: L. Raghavan, Chief, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Darl S. Hood, Senior Project Manager, Section 1 /RA/
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: MEETING BETWEEN THE NUCLEAR REGULATORY COMMISSION
STAFF AND STAKEHOLDERS CONCERNING GENERIC SAFETY
ISSUE 191, "ASSESSMENT OF DEBRIS ACCUMULATION ON PWR
SUMP PERFORMANCE" (TAC NO. MA6454)

On July 1, 2003, the Nuclear Regulatory Commission (NRC) staff met with the Nuclear Energy Institute (NEI), utility groups, and other stakeholders at NRC headquarters concerning Generic Safety Issue 191 (GSI-191), "Assessment of Debris Accumulation on PWR [pressurized-water reactor] Sump Performance."¹ Attachment 1 lists the meeting attendees.

A public meeting notice was issued on June 13, 2003, and was posted on the NRC's external (public) web page (ADAMS Accession No. ML031630838). The notice included the meeting agenda, which was also available as a handout at the meeting. The discussions included the status of (1) NRC generic communications relative to GSI-191, (2) the industry's methodology development efforts to address GSI-191, and (3) relevant research by the NRC's Office of the Nuclear Regulatory Research, including chemical effects tests by the Los Alamos National Laboratory.

In opening remarks, Mr. R. Architzel of the NRC staff noted the recent issuance of related Bulletin 2003-01, and stated that a draft generic letter for GSI-191 is currently scheduled for October 2003. The status of other related reports and correspondence were also discussed during the meeting as summarized below.

Industry's Plan to Address GSI-191

The NEI and industry representatives presented an "Update of the PWR Industry Plan to Address GSI-191" (Attachment 2). The update included the progress in the areas of:
(1) fracture mechanics application to identify and justify the use of a size of a breach piping to

¹ The July 1, 2003, meeting was preceded by a related public meeting on June 30, 2003, to discuss the NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors." The June 30, 2003, meeting is addressed by a separate meeting summary (ADAMS Accession No. ML032110559).

be used to evaluate consequential debris generation, (2) debris generation, (3) debris transport, and (4) net positive suction head loss methodology.

The fracture mechanics approach involves defining a stable through-wall flaw that, in turn, will provide the basis for evaluating consequential debris generation for hot leg, cold leg, crossover leg, and surge line piping. For any other piping break, a complete severing of the pipe is assumed. By letter dated April 18, 2003, the NEI submitted a white paper to the NRC on the fracture mechanics application. Amended text and additional information for the fracture mechanics application is scheduled for completion by the end of July 2003.

Regarding debris generation, the NEI and the industry have developed a draft document, "Debris Generation Methodology Guidance" (Attachment 3), to provide guidance on the methods to be used to determine the amount of debris generated by a postulated break in piping inside containment and the associated transport characteristics of that debris. This draft guide was amended to incorporate the NRC comments and has been provided for detailed review. The NRC staff noted that its evaluation of the NEI guidance regarding debris generation methodology is projected for late August 2004.

Regarding debris transport, guidance is being developed to determine the transport of debris by calculating the velocity of the liquid on the containment floor. Two methods of performing this calculation were discussed: (1) the hydraulic network modeling method which calculates bulk velocity of liquid moving across the containment floor in discrete paths or channels based on a nodal network (where a "node" is the junction of two or more flow paths); and (2) a computational fluid dynamics (CFD) computer code which, based on a detailed containment geometry model, calculates flow patterns in the liquid pool on the containment floor and provides local fluid velocities throughout the model region. By Attachment 4, a draft of the nodal network approach was provided for the NRC staff review. The NEI and the industry have initiated development of draft evaluation methodology for the CFD approach.

The NEI and the industry have also initiated development of a head loss methodology. This task involves a head loss equation, factors affecting limits of applicability (e.g., submerged and partially submerged sump screens), and inputs such as sump screen geometry, thermal-hydraulic conditions, debris accumulation, and debris bed morphology.

NRC Related Research

The NRC staff reviewed the status of four areas of related research by the NRC's Office of Nuclear Regulatory Research:

- (1) Revision 3 to Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of Coolant Accident," is scheduled for issuance in September 2003. Industry comments are being addressed and a meeting with the Advisory Committee on Reactor Safeguards is being scheduled.
- (2) A head loss task report is scheduled to be issued in September 2003.
- (3) Debris characterization for the PWR project will start in August 2003. This project will need debris samples from a number of plants.

- (4) A draft NUREG on the status and summary of chemical tests being conducted at the Los Alamos National Laboratory is scheduled for issuance for peer review in September 2003, with the final report expected in March 2004. Dr. B. Letellier of the Los Alamos National Laboratory summarized the recent testing to scope chemical and temperature induced degradation mechanisms that contribute to debris generation and head loss (Attachment 5). These tests show that (1) metal corrosion is credible for exposure to borated cooling water, (2) low solubility leads to precipitation at low concentrations, (3) significant head-loss can result from fiber debris beds, and a plant's vulnerability depends on the surface area of exposed metal and exposure time. Remaining tests include an incremental leaching cycle to measure the high temperature corrosion rate, immersion of consumer grade alkyd coating samples to monitor for qualitative degradation mechanisms, small-loop head-loss tests to monitor for chemical degradation effects, and a provision for correlating head-loss to debris bed mass.

The NRC asked whether it would be beneficial to the industry if the CASINOVA (Containment Accident Sequence Insulation Outcome Verification Analysis) computer code (see NUREG/CR-6762, Volume 1, pages 40-41; ADAMS Accession No. ML022470074) were made available, even though it is not a validated and verified code. NEI suggested that the NRC raise this question during the industry workshop scheduled for July 30-31, 2003.

Public Participation

Mr. P. Gunter of National Informational Resource Services asked if the NRC staff intends to rank plants for sump degradation/head-loss susceptibility. The NRC staff replied that, apart from a parametric study last year that examined the head-loss susceptibility of 69 "cases" which were composed of selected plant-specific features (e.g., available head and screen areas), no further parametric or ranking studies are planned.

- Attachments:
1. Meeting Attendees
 2. "Update of the PWR Industry Plan to Address GSI-191"
 3. Draft Guide, "Debris Generation Methodology Guidance," June 23, 2003
 4. Draft "PWR Sump Performance Evaluation Methodology: Velocity Calculation," June 21, 2003
 5. "Summary of Recent Chemical Effects Testing"

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ADAMS Accession No. ML032060400 (Meeting Summary)

ADAMS Accession No. ML032040118 (Attachment 2)

ADAMS Accession No. ML032030528 (Attachment 3)

ADAMS Accession No. ML032030535 (Attachment 4)

ADAMS Accession No. ML032090054 (Attachment 5)

ADAMS Accession No. ML032060420 (Package)

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LIST OF ATTENDEES

MEETING REGARDING GENERIC SAFETY ISSUE 191, "ASSESSMENT
OF DEBRIS ACCUMULATION ON PWR SUMP PERFORMANCE"

TUESDAY, JULY 1, 2003

<u>NAME</u>	<u>TITLE</u>	<u>ORGANIZATION</u>
D. Hood	Sr. Proj. Mgr.	NRC/NRR/DLPM
J. Lehning	Gen. Engineer	NRC/NRR/DSSA
R. Architzel	Sr. Reactor Eng.	NRC/NRR/DSSA
J. Hannon	Branch Chief	NRC/NRR/SPLB
R. Eckenrode	Sr. Human Factors Eng.	NRC/NRR/DIPM
B. Jain	Proj. Mgr.	NRC/RES/DET
C. Hunter	Engineer	NRC/RES/DRAA
G. DeMoss	Engineer	NRC/RES/DRAA
B. Letellier	staff	Los Alamos Nat. Lab
J. Butler	Sr. Proj. Mgr.	Nuclear Energy Institute
T. Pietrangelo	Director	Nuclear Energy Institute
T. Andreychek	Principal Engineer.	Westinghouse
M. Dingler	Engineer	WCNOC/WOG
M. Kastelwzk	Proj. Mgr.	CEG
R. Hermann	Associate	Structural Integrity Associates
K. Anstee	Civ. Eng. Consultant	Constellation Gen. Group
K. Kishioka	Washington Representative	Japan Atomic Power
K. Leonelli	Engineer	SCE&G
A. Smith	Proj. Mgr.	Enercon Services
J. Cavallo	Vice President	CCC&L Inc.
G. Sutoriano	Engineer	Pacific Gas & Elect.
M. Friedman	Engineer	Omaha Public Power District
R. DeCanto	Sr. Engineer	Dominion Nuclear
J. Hoffman	Staff Engineer	Florida Power and Light
G. Twachtman	Assist. Editor	Platts Nuclear
N. Chapman	SERCH Manager	SERCH/Bechtel
J. Brokin	Sr. Engineer	Arizona Power Service Company
R. Bryan	Engineering Director	ENERCON
K. Kopecky	Licensing Engr.	Southern Nuclear
P. Mast	President	ITS Corp.
G. Zigler	Sr. Engineer	ITS Corp.
R. Oakley	Sr. Engineer	Duke Energy
G. Kent	Engineer	Duke Energy
C. Hunter	Proj. Mgr.	Exelon

<u>NAME</u>	<u>TITLE</u>	<u>ORGANIZATION</u>
J. Bleigh	Engineered Sys. Mgr.	Performance Contracting, Inc.
G. Wert	Consulting Engr.	Performance Contracting, Inc.
C. Harrington	Consulting Engr.	TXU Energy
A. Bitanin	Sr. Associate	Continuum Dynamics
G. Geaney	Consulting Engr.	MPR Associates
D. Raleigh	Client Mgr.	Lis. Scientech
D. Lochbam	Nuclear Safety Eng.	Union of Concerned Scientists
P. Gunter		Nat. Info. Resource Services

NRR = Office of Nuclear Reactor Regulation
DLPM = Division of Licensing Project Management
DSSA = Division of Systems Safety and Analysis
DE = Division of Engineering
DIPM = Division of Inspection Program Management
RES = Office of Nuclear Regulatory Research
DET = Division of Engineering Technology